

CARTOGRAPHIC EDUCATION OF SURVEYORS WITHIN THE UNIVERSITY OF PRISHTINA

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Abstract. University of Prishtina with 16 faculties is the most important educational, scientific and cultural institution in Kosova, with 43 years' experience in higher education system.

High education of surveyors within the University of Prishtina is organized in the Faculty of civil engineering and architecture, as 3 year bachelor studies. The course is very young, which was begun in year 2003.

Within very short period of 10 year experience, two totally different curricula's were in use. First one was in use from the beginning till year 2009, and the second one from academic year 2007/08. Compared with the older one, new curricula's consists more cartographic subjects, as map projections, topographic cartography, web cartography, geodetic maps, general cartography, geoinformation modeling etc.

As software platforms, both, commercial and free/open source software are in use for data processing, editing, compilation and publishing. From commercial software, ArcGIS, geomedia, global mapper and AutoCADMap 3D are in use, and from free and open source software as most utilized are map maker, micro dem, quantum GIS, Merkaator, grass gis, map window gis, autodesk 123d, ArcGIS online, map server, geo server etc.

As results from the process of cartographic education within the surveying department of the University of Prishtina, bellow list of products have been compiled with the surveying students: creating of road map of Kosova, touristic maps of some Kosova cities, calculation of the state area of Kosova, using Civil 3d and autocad map 3d for geodetic calculations/transformations, research of alternative map projections for Kosova, analyses of Gauss-Kryger projection in a case of Kosovaref01, analyses of creating DTM and its quality, developing Kosova's GM dataset, automation of tiling reference systems for the area of Kosova, etc.

Keywords: Education, Cartography, Surveyors, Prishtina, Kosova

1. Introduction

Education of surveyors in Kosova in the field of surveying, before its independence was conducted mainly in university centers of the former Yugoslavia, as well as in other European countries. As most visited centers in Yugoslavia were Zagreb, Sarajevo and Belgrade universities, and Skopje high school.

Beginning of surveying education in Kosovo on year 2003 is the opening of surveying department within the faculty of civil engineering and architecture, as a three-year Bachelor studies. High education of surveyors in Kosova in a field of cartography currently is part of the six programs that were directly related to mapping, which came as a result of new curricula that began in year 2007.

2. Surveying department

2.1. University of Prishtina

The University of Prishtina is the most important educational, scientific and cultural institution in Kosova. For more than forty years it was the sole carrier of higher education. The University of Prishtina is relatively new – forty-three years old, but the path of its development was dynamic, and the educational, scientific and artistic activities were rich and with great results, with undeniable and historic weight.

The first institution of higher education in Kosova was the Higher Pedagogical School in Prishtina (1958). Till year 1970, several independent high institutions have been established, such as higher schools and faculties, in total 13 higher education institutions.

The University of Prishtina was founded by the SAP Kosova Assembly, which approved the Law on the Foundation of the University of Prishtina on 18 November 1969, with faculties of philosophy, of law and economics, of engineering and the medical faculty. The Foundation Assembly of the University of Prishtina was held on 13 February 1970.

From year 1970 till today, the history of University of Prishtina passed through four totally different periods of its development:

- 1970-1981, founding and development of university,
- 1981-1991, political and police repression against in university,
- 1991-1999, survival of the university,
- after 1999, light of reforms and implementing of ECTS in university.

In year 2001, the Senate of the University of Prishtina adopted the teaching curricula based on the Bologna Declaration for the bachelor level.

Today, university consist sixteen faculties, mainly located in Prishtina, except two of them which are located in Mitrovice and Ferizaj: Faculty of Philosophy, Faculty of Mathematics and Natural Sciences, Faculty of Philology, Faculty of Law, Faculty of Economics, Faculty of Engineering and Architecture, Faculty of Electrical and Computer Engineering, Faculty of Mechanical Engineering, Faculty of Medicine, Faculty of Arts, Faculty of Agriculture and Veterinary, Faculty of Geosciences and Technology, Faculty of Sport Sciences, Faculty of Education, Faculty of Applied Sciences and Engineering - Mitrovice, Faculty of Applied Sciences and Engineering – Ferizaj (<http://www.uni-pr.edu/Fakultetet.aspx>, march 2013).

2.2. Faculty of Civil Engineering and Architecture

The Faculty was erected on the foundations of the Higher Engineering School in Prishtina, on 20/10/1961, with sections of Civil Engineering, Electrical Engineering and Mechanical Engineering. In year 1965, the Executive Council of Kosova adopted the Law on the Establishment of the Faculty of Engineering with the Section of Civil Engineering.

The Faculty of Engineering was transformed on year 1988 on which occasion it was divided into three faculties: the Faculty of Civil Engineering and Architecture, Faculty of Electrical Engineering and Faculty of Mechanical Engineering. The Assembly of Kosova approved the Law on the Establishment of the Faculty of Civil Engineering and Architecture, on 25 February 1988 (monograph, 2005).

Today, faculty of civil engineering and architecture consists two sections, civil engineering and architecture, where the civil engineering section consist construction, hydro-technique and surveying courses.

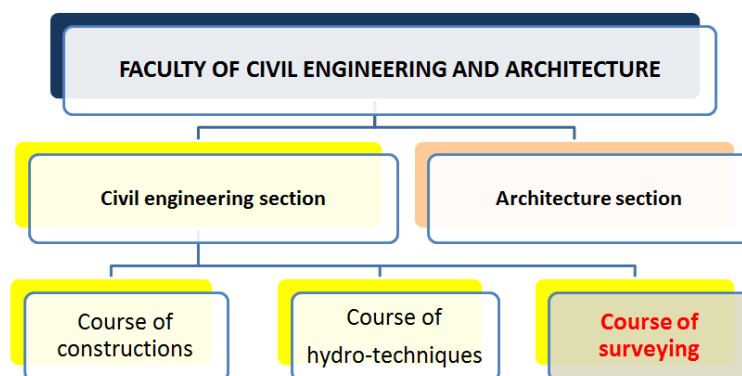


Figure 1. Sections and courses within the Faculty of Civil Engineering and Architecture in Prishtina.

Beside bachelor courses, in June 2004, the curricula's for master studies were adopted for the following sections: 1. the Section of Civil Engineering – the Constructive and Hydraulic Directions, and 2. the Section of Architecture – Direction of Planning and Urban Management, and Direction of Projecting (monograph, 2005).

2.3. Surveying department

Surveying department within the faculty of civil engineering and architecture is very young department, which has been established on academic year 2003/04, with 30 students registered in first generation.

Currently, within the department, only the bachelor studies with three year duration are organized. Many efforts for beginning with the master course in surveying have been made last years. Because of lack of academic staff and technical equipment, beginning of master course in surveying is not possible with current conditions.

For 10 year of its operation, number of students in surveying department is in permanent increasing. On current academic year 2012/13, 80 students started their studies in surveying department. For 10 years, 570 students have been registered for studying, from which about 110 students have already finished their studies and got academic degree "bachelor of surveying".

3. Cartographic education within the surveying department

3.1. Curricula's of surveying department

Within very short period of 10 year functionality, two totally different curricula's were in use for bachelor course on surveying. First one was in use from the beginning till year 2009 (table 1), and the second one has been started from academic year 2007/08 (table 2).

On year 2007, essential changes in bachelor surveying curricula's have been made. Purposes of big changes are lack of master study course for surveying in the University of Prishtina, and market orientation of curricula's based on current needs of governmental institutions and geo market in Kosova.

In next two tables, both curricula's, older and newest one are given, with details about number of lectures and exercises, status obligatory or with election, semester, and number of ECTS for all subjects (http://fna.uni-pr.edu/Files/Dokumente/Relevante/pasqyra_up_2008.aspx).

Table 1. Curricula of surveying department Prishtina from 2003 to 2009

Nr	Subject	Status	L+E	ECTS	Nr	Subject	Status	L+E	ECTS
Semester 1					Semester 2				
1	Mathematics 1	Obligatory	3+3	7	1	Mathematics 2	Obligatory	3+3	7
2	Descriptive geometry 1	Obligatory	2+2	5	2	Descriptive geometry 2	Obligatory	2+2	5
3	Physics 1	Obligatory	2+2	5	3	Practical geodesy 2	Obligatory	3+3	6
4	Practical geodesy 1	Obligatory	3+3	7	4	Geodetic drawing	Obligatory	1+2	4
5	Foreign language	Obligatory	2+0	2	5	Foreign language	Obligatory	2+0	2
6	Sociology	Optional	2+0	4	6	Physics 2	Optional	2+2	4
7	Computer and informatics	Optional	2+2	4	7	Geoinformatics 1	Optional	2+2	4
					8	Academic writing with communication	Optional	0+2	2
Semester 3					Semester 4				
1	Mathematics 3	Obligatory	3+3	7	1	Geoinformatics 3	Obligatory	2+2	5
2	Geoinformatics 2	Obligatory	2+2	5	2	Practical geodesy 4	Obligatory	3+3	7
3	Practical geodesy 3	Obligatory	3+3	6	3	Theory of errors with adjustments 1	Obligatory	3+3	6
4	Topography	Obligatory	2+2	5	4	Real estate cadastre 1	Obligatory	2+2	5
5	Foreign language	Obligatory	2+0	2	5	Foreign language	Obligatory	2+0	2
6	Mechanics	Optional	2+2	5	6	Mathematics 4	Optional	3+3	5
7	Geodetic software's	Optional	2+2	5	7	Geodetic astronomy 1	Optional	2+2	5
Semester 5					Semester 6				
1	Theory of errors 2	Obligatory	2+2	6	1	Engineering geodesy 2	Obligatory	3+3	7
2	Engineering geodesy 1	Obligatory	3+3	7	2	Introduction into GIS	Obligatory	2+2	6
3	Real estate cadastre 2	Obligatory	2+2	6	3	Land development 2	Obligatory	2+2	6
4	Land development 1	Obligatory	2+2	6	4	State survey 2	Optional	2+2	6
5	Photogrammetry	Optional	2+2	6	5	Geodesy and environment protection	Optional	2+2	6
6	State survey	Optional	2+2	6	6	Physical planning and urbanistics	Optional	2+1	5
7	Road projects	Optional	2+2	6	DIPLOMA THESIS				
8	Geodetic astronomy 2	Optional	2+2	5					

Table 2. Current curricula of surveying department Prishtina, started from academic year 2007/2008

Nr	Subject	Status	L+E	ECTS	Nr	Subject	Status	L+E	ECTS
Semester 1					Semester 2				
1	Linear algebra and analytical geometry	Obligatory	2+2	6	1	Computer geometry	Obligatory	2+2	6
2	Programming	Obligatory	2+2	6	2	Mathematical analyses	Obligatory	2+2	6
3	Basics of geoinformatics and informatics	Obligatory	2+2	6	3	Land surveying	Obligatory	2+2	6
4	Geodetic instruments and introduction into geodesy	Obligatory	2+2	6	4	Analyses and processing of geodetic measurements	Obligatory	2+2	6
5	Foreign language	Optional	2+0	6	5	Field measurements	Optional	2+2	6
6	Physics	Optional	2+2	6	6	Basics of property rights for land registration	Optional	2+2	6
					7	Spherical trigonometry	Optional	2+2	6
Semester 3					Semester 4				
1	Databases	Obligatory	3+2	7	1	Cartography	Obligatory	2+2	6
2	Differential geometry	Obligatory	2+2	6	2	Geodetic reference frames	Obligatory	2+2	6
3	Cadastral	Obligatory	2+2	6	3	Photogrammetry	Obligatory	2+2	6
4	Geodetic plans	Obligatory	2+2	6	4	Utilization of geoinformations	Obligatory	2+2	6
5	Topography	Optional	2+1	5	5	Geoinformation modeling	Obligatory	2+2	6
6	Practical work with geodetic instruments	Optional	2+2	5					
Semester 5					Semester 6				
1	Satellite positioning	Obligatory	2+2	6	1	Engineering geodesy	Obligatory	2+2	6
2	Engineering geodetic basis	Obligatory	2+2	6	2	State survey	Obligatory	2+2	6
3	Remote sensing	Obligatory	2+2	6	3	Map projections	Obligatory	2+2	6
4	Land development	Obligatory	2+2	6	4	DIPLOMA THESIS			
5	Land information systems	Optional	2+2	6	5	Geoinformation infrastructure	Optional	2+2	4
6	Topographic cartography	Optional	2+2	6	6	Web cartography	Optional	2+2	4
					7	Basics of geodetic astronomy	Optional	2+2	4
					8	Hydrographic survey	Optional	2+2	4

Compared with the older one, new curricula's consists more cartographic subjects, as map projections, topographic cartography, web cartography, geodetic maps, general cartography, geoinformation modeling etc. New curricula gave to surveyor's wide range of knowledge, for practical work in sector of cartography, and to deal with many types of mapping projects.

3.2. Software and technical equipment

As technical equipment, department is quite poor with utilization of latest technology. Actually department doesn't have special laboratory for cartography and GIS, as well as laboratories for another surveying fields.

From the software platforms, for exercises in use are commercial and open source software. Below is given the list of both software groups which are in use by surveying students in Prishtina for processing, editing, compilation and publishing of geospatial data:

Commercial software:

- ArcGIS,
- geomedia,
- global mapper and
- AutoCAD Map 3D.

Free and open source software:

- micro dem,
- quantum GIS,
- Merkaator,
- grass gis,
- map window gis,
- autodesk 123d,
- map maker,
- ArcGIS online,
- map server,
- geo server etc.

3.3. Professional cartographic literature

Before establishment of surveying department, the professional literature for higher education in a field of cartography in Kosova was very poor. Just two university cartography books published from the geography department in Prishtina existed in university library of Prishtina.

Beside them, many university books in a cartography field in Albanian language have been published in Tirana, within the surveying department of Polytechnic University of Tirana.

Currently, books in Albanian language given in below list are in use for lectures and exercises by students in surveying department, which are combination of publications in Prishtina, Skopje and Tirana:

- Përpilimi i hartave & Përgjithësimi hartografik (2006), Bashkim Idrizi, Shkup,
- Hartografi – praktikum i ushtrimeve (2006), Bashkim Idrizi, Shkup,
- Hartografia (2000), Murat Meha, Prishtina,
- Hartografia 1 – matematike (1985), Agim Shehu & Ergjin Samimi, Tirana,
- Historia e hartografisë shqiptare (2000), Agim Shehu & Pal Nikolli, Tirana,
- Topografia – dispensë (2009), Bashkim Idrizi, Prishtinë,
- Hartografia topografike – dispensë (2010), Bashkim Idrizi, Prishtinë,
- Hartografia matematike – dispensë (2011), Bashkim Idrizi, Prishtinë, and
- Gjeodezia e lartë 1 (1990), Sali Çene & Qemal Skuka, Tiranë.

Books and manuscripts in upper list cannot serve all cartographic subjects of current curricula's, as web mapping, geoinformation modeling etc. It is a challenge for lecturers of department in a future period, as well as for Albanian cartography lecturers in Tetova and Tirana.

3.4. Diploma thesis's of surveyors in a field of cartography

Cartography is very interesting and attractive field for surveying students in Prishtina. Most of them elect cartographic subjects from the list of subjects for election, and considerable number of them (18 out of about 110) has worked their diploma thesis in a field of cartography. Below is the list of diploma thesis form cartography field realized within the surveying department in Prishtina, started from year 2008 till April 2013, after the adapting of new curricula for surveying in year 2007:

- Projecting of the Republic of Kosova in Gauss-Kryger's projection, 2008
- Alternative variants of state map projection for the Republic of Kosovo, 2008
- Developing Kosova Global Map vector dataset, 2009
- Creating of map symbols and database structure for topographic maps in scale 1:50.000 based on NATO standards, 2010

- Utilization of Autodesk Civil 3d and Map 3d for calculations of map projection elements, 2010
- Compilation of Kosova road map, 2011
- Compilation of touristic map for the city of Gjilan, 2011
- Compilation of touristic map for the city of Peja, 2011
- Calculating area of territory of the Republic of Kosova, 2011
- Creating of map symbols and database structure for topographic maps of Kosova in scale 1:25.000, 2011
- Tiling systems for the territory of the Republic of Kosova, 2011
- Analyses of giving options of Civil 3d software for creating digital terrain model, 2011
- Calculation volumes with AutodCAD Civil 3d and Plateia, 2012
- Utilization of some global digital elevation models for territory of Kosova, 2012
- Cartographic representing of cultural, educational and sportive objects in usage of Albanians in the Municipality of Bujanoc, 2012
- Cartographic compilation of geoid heights, ellipsoidal heights and elevations for the territory of the Republic of Kosova, 2012
- Compilation map of cultures and classes for cadastral zone Softaj in the Ferizaj municipality, 2012 and
- Compilation of topographic map in scale 1:25.000 for "Hodonoc", 2013.

Geospatial database developed within diploma thesis with title „Developing Kosova Global Map vector dataset (2009)“, has been used for developing the Kosova's Global Map database by the Kosova Cadastral Agency within the Global Mapping project, which has been officially released as part of Global Map on 19 August 2011 (<http://www.iscgm.org>).

As outcome of successful cooperation between cartographic lecturer of department with students which were degreed in a field of cartography, three scientific papers have been published in international conferences. The list of papers are given in a below list:

- Idrizi B., Bajrami F., Lubishtani M., (2009): Projecting of territory of the Republic of Kosova in several most used state map projections; FIG; Eilat, Israel. ISBN 978-87-90907-73-0
- Idrizi B., Nikolli P., Hyseni D. (2010): Kosova in Global Map; Third International conference on Cartography and GIS; Nesebar; Bulgaria. ISSN 1314-0604
- Idrizi B., Meha M., Ismaili F., Nikolli P. (2012): Calculation of the National Area of the Republic of Kosova; Proceedings - FIG working week, Rome, Italy. ISBN: 97887-90907-98-3

4. Conclusions

The results of surveying students in a field of cartography are apparent in their study phase. Seriousness of the diploma thesis's, their publishing as papers in international conferences of FIG and ICA, and utilization of data-base developed within diploma thesis for developing of official Kosova's Global Map dataset, are very clear indicators for the quality of university education in a field of cartography of young surveyors in University of Prishtina.

New curricula for surveying within the Faculty of civil engineering and architecture in Prishtina, gave opportunities for developing of state cartography of Kosova. Due to lack of high education in cartography field in a past period, developing of cartography, especially of the state cartography in Kosova was in stagnation!

Beside upper mentioned positive results, cartographic education needs further development within the surveying department in Prishtina, by increasing the number of academic staff in cartography field, publishing new university books and involvement in national and international professional cartographic projects.

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